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Originating Office: AIR-6B0	**Document Description:** TSO-C179b Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems	**Project Lead/Reviewer** Norman Pereira	**Reviewing Office:** AIR-6B3	**Date of Review:** 23 March 2018

	Commenter	**Section # and Page #**	**Comment**	**Suggested Change and Rationale**	**Disposition**
1.	B. BROUSSE Airbus Helicopters	General (can be in link with 1. PURPOSE section)	AH felt necessary to clarify that TSO may be applicable to equipment containing a lithium battery All paragraphs of the TSO should consider and make possible TSOA at equipment.	Add a § like in TSO C142b section *4. MARKING) b. Mark the non-rechargeable lithium cell, battery or end item based on the following table:* […] Use same wording in both TSO	Partially accepted. The chemistry for rechargeable and non-rechargeable are not the same. In RTCA DO-311A, this same hazard assessment was addressed by the addition of venting categories. There is system level testing and validation.
2.	B. BROUSSE Airbus Helicopters	Entire document	When mentioning DO-254 wording of TSO C142b and TSO C179b should be aligned. In addition it should be in line with future AC20-152.	Use same wording in both TSO	Accepted. TSO updated.
3.	B. BROUSSE Airbus Helicopters	4)a. page 2	At battery level (multiple cells) AH is Ok with the requirement about serial number marking, but for single cells some batteries may only be marked with lot number and not Serial number.	Add possibility to mention date or other dating period of manufacture or lot number instead of Serial Number for single cell batteries	Accepted. TSO updated to battery and battery system.

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4.	B. BROUSSE Airbus Helicopters	Appendix 1)h. page 7	If RTCA/DO-311A appendix C is removed as requested in TSOC179b draft document, the TSO C179b CLASS B classification will never been achieved. AH feeling is that TSO should offer the possibility to demonstrate compliance trough Alternative MOC. Appendix C of DO-311A should remain possible MOC. We think that this point needs to be clarified.	Integrate possibility to demonstrate compliance through AMOC in TSO document and/or allow Appendix C as Alternative MOC TSO Class as described in section 4. Marking should be in line with what is mentioned in appendix 1 of draft TSO-C179b document	Not accepted The FAA has not accepted use of Appendix C in RTCA/DO-311A as an alternate MOC to section 2.4.5.5. Please see Executive Summary on page i- last sentence. Testing is still accomplished and the results may be acceptable for installation approval, so there are alternative paths. However, we deleted Appendix 1 from the TSO. The TSO Class allows an option for a TSOA. A TSO applicant can still obtain approval for TSO-C179b Class B, where not all cells go into thermal runaway.

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Originating Office: AIR-6B0	**Document Description:** TSO-C179b Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems	**Project Lead/Reviewer** Norman Pereira	**Reviewing Office:**	**Date of Review:**

	Commenter	**Section # and Page #**	**Comment**	**Suggested Change and Rationale**	**Disposition**
5.	BOEING	Page 3, Paragraph 1	TSO C179b CLASS A – During the RTCA/DO-311A section 2.4.5.5 Battery Thermal Runaway Containment Test All cells within the battery must enter Thermal Runaway. TSO C179b CLASS B – During the RTCA/DO-311A section 2.4.5.5 Battery Thermal Runaway Containment Test Not all cells within the battery enter Thermal Runaway.	Remove Class A and Class B distinction.	Not accepted. Class A and Class B were introduced to allow an option for TSO applicants, based on different aircraft (14 CFR part) requirements.
6.	BOEING	Page: 4 Para: Section 5 a. (2) Page: 5 Para: Section 6 b.	One copy of the test results from the testing using RTCA DO-311A, Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems, dated 19 December, 2017.	One copy of the test results including test methods, data, and reportables from the testing using RTCA DO-311A, Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems, dated 19 December, 2017.	Accepted. TSO updated

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7.	BOEING	Page: 6 Para: Section 7 a.	When furnishing one or more articles manufactured under this TSO to one entity (such as an operator or repair station), provide one copy or on-line access to the data in paragraphs 5.a and 5.b of this TSO. Add any other data needed for the proper installation, certification, use, or for continued compliance with the TSO, of the rechargeable lithium batteries and battery systems.	When furnishing one or more articles manufactured under this TSO to one entity (such as an installer, operator or repair station), provide one copy or on-line access to the data in paragraphs 5.a and 5.b of this TSO. Add any other data needed for the proper installation, certification, use, or for continued compliance with the TSO, of the rechargeable lithium batteries and battery systems.	Accepted. TSO updated
8.	BOEING	Page: 7 Para: Table 1	The proposed text states: "Delete this section."	We recommend revising the text as follows: "Not applicable to this TSO."	Partially accepted. The FAA does not acknowledge Appendix C. See RTCA/DO-311A Executive Summary last sentence. However, we deleted Appendix 1 of this TSO, and added a reference to exclude Appendix C on page 1.
9.	BOEING	Page: 7 Para: 2	"We modified the standard, as follows:"	"The FAA has determined that the content of DO-311A Appendix C shall not be utilized by applicants seeking TSO approval."	Partially accepted. Appendix 1 was deleted and paragraph 3 is further clarified to exclude Appendix C.

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10.	EMBRAER	APPENDIX 1 Page 7	APPENDIX C should not be deleted. Appendix C describes a test procedure which provides an additional means of showing compliance to the Battery Thermal Runaway Containment (BTRC) requirement stated in section 2.2.2.4. The procedure in Appendix C was developed by SC-225 subject matter experts to be fully compliant with the BTRC requirement. Appendix C prescribes pairs of cells to be forced into thermal runaway nearly simultaneously in order to produce a resultant heat pulse approximately twice as great as a single cell failure. Testing two cells at once is compliant with the DO-311A requirement to force "multiple cells", into thermal runaway, which the 2.4.5.5 BTRC Test Procedure defines as "two or more". There is no language in DO-311A which stipulates the "multiple cells" or a less-defined "majority of the cells" requirement must be met by an "all cells at once", or an undefined "quick succession" test procedure as suggested by the authors of the dissent letter. The Appendix C test is not only a means to demonstrate compliance with the BTRC requirements (Section 2.2.2.4), but also the requirements stated in 14 CFR parts xx.1301 and xx.1309 that are the basis for safe aircraft system design. Both test methods (BTRC and Appendix C) can be used to provide the necessary input to airplane-level system safety assessments.	Remove APPENDIX 1 from TSO-C179b	Partially accepted. Although Appendix 1 of this TSO was deleted, the FAA does not acknowledge RTCA/DO-311A Appendix C. (Please see Executive Summary last sentence.)

11.	GAMA	Sect 3; pg 1	Section 3 calls out DO-311A sections that are not requirements.	Reference the correct RTCA document, DO- 311A, Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems, dated 19 December 2017.section references throughout the document.	Not accepted. The TSO is a design and production approval. It includes design, manufacturing test and validation processes. Section 1 does include design and production aspects that will be required for the TSO.
12.	GAMA	Sect 4.a. & 4.b.; pg 2-3	The marking requirements in these sections are ambiguous and potentially onerous…	General: A simpler and more straight-forward marking scheme is required - "Mark battery per RTCA/DO-311A Energy and Venting category" or similar.	Accepted. The marking was updated based on a similar comment as well.
13.	GAMA	Sect 4.b; pg 2	"Mark the lithium cell, battery and battery system based on the following table:"	SUGGESTED CHANGE: "Mark the lithium cell, battery or battery system based on the following table:" RATIONALE: "AND" in the original statement implies all combinations. Like in paragraph 4.a, the marking should only be on the highest or certified level of the product.	Accepted. TSO updated with battery or battery system, cells removed from the statement.

14.	GAMA	Sect 4.b; pg 3	"Label the TSO as TSO C179b- CLASS A-X or TSO C179b-CLASS B-X as shown below (where –X stands for energy and venting category as listed in the table below): TSO C179b CLASS A – During the RTCA/DO-311A section 2.4.5.5 Battery Thermal Runaway Containment Test All cells within the battery must enter Thermal Runaway. TSO C179b CLASS B – During the RTCA/DO-311A section 2.4.5.5 Battery Thermal Runaway Containment Test Not all cells within the battery enter Thermal Runaway.	SUGGESTED CHANGE: "Label the TSO as TSO C179b-X (where –X stands for energy and venting category as listed in the table below):" (strike the follow- on definitions of Class A and Class B) RATIONALE: There is no inherent value in identifying whether ALL cells within a battery experience thermal runaway during DO-311A, 2.4.5.5. The test requires that the entire battery be subjected to conditions that must initiate a thermal runaway (TR). Additionally, evidence must be produced that multiple cells have actually experienced TR. This is sufficient to identify the likely hazard associated with a worst-case scenario. If some, but not all, of the cells in a battery experience TR, this is a natural consequence of the battery design and representative of its hazard. Using a Classification system to indicate that a battery which has 7 of 8 cells experience TR should somehow be limited in its application, rather than one that demonstrates 8 of 8 cells, would not be useful or appropriate. (or 99 of 100, etc) And because there is no currently defined impact/result as to identifying a product as Class A or Class B, it seems additionally	Not accepted. The Class A and B test results are meant to identify two different configurations that will assist in installation approval.

				somehow be limited in its application, rather than one that demonstrates 8 of 8 cells, would not be useful or appropriate. (or 99 of 100, etc) And because there is no currently defined impact/result as to identifying a product as Class A or Class B, it seems additionally unnecessary to differentiate products at such a high level as the TSO qualification based on this factor. Review of the test results during the installation certification would be a more appropriate place to determine the potential risk or implications of a battery in which a majority of the cells did/did not experience TR.	

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15.	GAMA	Sect 4.b; pg 3	"Label the TSO as TSO C179b- CLASS A-X or TSO C179b- CLASS B-X as shown below (where –X stands for energy and venting category as listed in the table below):" – [reference table]	SUGGESTED CHANGE: "Label the TSO as TSO C179b-X (where –X stands for energy and venting category as listed in the table below):" [referenced table] -X Energy Venting -1A 1 A -1B 1 B -1C 1 C -2A 2 A … etc RATIONALE: Since X could potentially represent a 2-digit number anyway in the currently proposed version, TBP recommends to simply identify the Energy and Venting categories with their actual designation per the DO-311A document rather than a 'translated' equivalent that requires decoding. A second, but less desirable alternative might be an "- X" that is represented by -11, -12, -13, -21, - 22, -23, -31… etc. That way, it is more interpretable without referencing the table.	Accepted. The TSO was updated with a similar label as the suggested labelling scheme for energy and venting designation.

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16.	GAMA	Sect 4.c; pg 3	"Also, mark the following permanently and legibly, with at least the manufacturer's name, subassembly part number, and the TSO number:"	SUGGESTED CHANGE: "Also, mark the following permanently and legibly, with at least the manufacturer's name and subassembly part number:" RATIONALE: It would not be appropriate to mark individual removable components or sub-assemblies with the TSO number. That would indicate that those components/sub-assemblies are TSO'd, when in fact, they are not unless installed as part of the TSO'd system. However, as additional indication, you could require that removable components or sub-assemblies be marked with a serial number.	Partially accepted. The TSO was updated to clarify this section only applies to subassembly part number of the approved TSO configuration. We removed the TSO number requirement.

17.	GAMA	Sect 5.a; pg 4	"**(2)** One copy of the test results from the testing using *RTCA DO- 311A, Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems,* dated 19 *December,* 2017."	SUGGESTED CHANGE: Move and/or append this section to 5.j. Renumber sections 5.a(3)-(6) to 5.a(2)-(5). RATIONALE: According to Section 7.a, the TSO holder must provide the data in 5.a and 5.b to an entity (operator or repair station). However, the data in 5.a and 5.b is typical of a product's Install and Operation Manual. It would not be practical or within the scope of the information to include the DO-311A test results. Also, 5.a(2) is essentially identical to 5.j. Therefore, we recommend they be combined in 5.j. This is similar to other TSO's as well (ref C201 for example) Also note that the statement in 7.a says: "Add any other data needed for the proper installation, certification, use, or for continued compliance with the TSO, of the rechargeable lithium batteries and battery systems." This would include the DO-311A test results (so the installer can review as needed). If desired, additional emphasis could be placed on this in 7.a. (See next comment/suggestion)	Partially accepted The TSO section 5.a.(2) was updated to require a summary of test results including pass/fail criteria and the required reportable information according to paragraph 3 of this TSO.

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18.	GAMA	Sect 5.a.(2); pg 4	Section 5.a.(2) states: "One copy of the test results from the testing using RTCA DO-311A, Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems, dated 19 December 2017."	SUGGESTED CHANGE: Delete section 5.a.(2). The provision of all test data as requested is not practical. We suggest only a limited subset necessary to support integration and installation of a battery system. We recommend further FAA/Industry discussion to define the appropriate minimum test data set to support this requirement.	Partially accepted. TSO updated to require a summary of test results including pass/fail criteria and the required reportable information according to paragraph 3 of this TSO.

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19.	GAMA	Sect 7.a; pg 6	"Add any other data needed for the proper installation, certification, use, or for continued compliance with the TSO, of the rechargeable lithium batteries and battery systems."	SUGGESTED CHANGE: "Add any other data needed for the proper installation, certification, use, or for continued compliance with the TSO, including the test results associated with RTCA/DO-311A as required, for the rechargeable lithium batteries and battery systems." RATIONALE: This highlights the potential need of the installer to review the RTCA/DO-311A test results of the product and compels the manufacturer to provide it on request. (However, in conjunction with Comment #5 above, does not require the distribution of those results in otherwise public documentation that is out of scope.)	Accepted. The TSO was updated to include this information in 5 a.2.
20.	GAMA	Sect 8.b; pg 6	"b. Order SAE documents…"	SUGGESTED CHANGE: Remove Section 8.b. RATIONALE: There are no SAE documents referenced in the TSO. It could be removed from the "How to Get Referenced Documents"	Accepted. TSO updated.

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21.	Garmin	Sec 2.a Page 1	Section 2.a is not consistent with the Order 8150.1D Appendix G TSO template that allows *"{insert date 18 months after publication}*". Development of TSO products take substantial time and if already developing to the previous publication, 6 months is not sufficient time to complete the TSO application.	Follow Order 8150.1D and use the suggested text of *"{insert date 18 months after publication}*"	Not accepted. This TSO update is a safety critical one and timing is also critical.
22.	Garmin	Sec 3 Page 1	Section 3 calls out DO-311A sections that are not requirements; specifically: • DO-311A Sec 1 doesn't contain requirements. Sec 1.4 has categories that should be referenced to define the applicable requirements but not listed as a requirement in the TSO. • Appendix 1 amends a test procedure and should be called out from TSO par 3.b. Additionally, section 3 of the draft TSO includes the words "MPS qualification and documentation" which does not match the Order 8150.1D Appendix G TSO template.	"… date of this TSO must meet the requirements in Sections 2.1 and 2.2 of RTCA document, DO-311A, *Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems*, dated 19 December, 2017. The energy categories …"	Not accepted. The TSO is a design and production approval. It includes design, manufacturing test and validation processes. Section 1 does include design and production aspects that will be required for the TSO. Section 2.3 also contain pertinent testing requirements.

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23.	Garmin	Sec 3.c. Page 2	Section 3.c calls out a DO-311A section that does not have test conditions. DO-311A Sec 2.4 should be called out since it is the Test Procedure section. Also, the "as amended by Appendix 1 of this TSO" should be in section 3.c since Appendix 1 is amending a test procedure in the MOPS, not an equipment requirement.	"Demonstrate the required functional performance under the test conditions specified in section 2.4 of RTCA DO-311A, *Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems*, dated 19 December, 2017 and as amended by Appendix 1 of this TSO." Additionally, italics should be removed from "December" in this section.	Partially accepted. The TSO is a design and production approval. It includes design, manufacturing test and validation processes. Section 1 does include design and production aspects that will be required for the TSO. Section 2.3 also contain pertinent testing requirements. Section 3 was clarified; Italics was removed from 'December'.
24.	Garmin	Sec 3.d Page 2	Section 3.d is missing the Note from the Order 8150.1D Appendix G TSO template stating that use of 160D (with changes) or earlier is generally not considered appropriate. Since DO-311A doesn't state which DO-160 revision is required, this note will provide guidance on the appropriate environmental standard	Add Note from the Order 8150.1D Appendix G TSO template. Additionally, italics should be removed from "December" in this section.	Accepted TSO updated. Italics was removed from 'December'.

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25.	Garmin	Sec 4.a & 4.b Pages 2-3	The marking requirements in these sections are ambiguous and potentially onerous. 4.a. requires marking each cell and 4.b requires marking the lithium cell. Many batteries contain multiple battery cells (potentially hundreds of cells for large batteries). Marking at the LRU level should be sufficient, but if this is what is intended, it is not evident.	Use the terminology in DO-311A 2.1.3.1 (standalone battery) and 2.1.3.2 (embedded battery) which is clear and reasonable. This allows for marking at the LRU level (not individual cells).	Partially accepted. The marking listed on the TSO is per 14 CFR part 21 for the article. The TSO approval certifies the battery as the TSO article, the battery is marked and not each individual cell inside the battery. The markings based on the table is specifically to allow two classes of this TSO.
26.	Garmin	Sec 4.b Page 3	Section 4.b calls out an additional table specifying a new class above and beyond what was intended by DO-311A based on the results of the whole battery thermal runaway containment test. The intent of this DO-311A test was never to require that all cells enter thermal runaway. Particularly for large cells, this forces the manufacturer to choose claiming a lower classification, or significantly increasing the complexity of the test to ensure all cells enter thermal runaway.	Remove the Class A/B marking requirement, as it does not reflect the intent of the whole battery thermal runaway containment test as defined in DO-311A.	Not accepted. The addition of Class A and B is to provide an option for TSO applicants.

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27.	Garmin	Sec 4.c. Page 3	Section 4.c includes the following text: c. Also, mark the following permanently and legibly, with at least the manufacturer's name, subassembly part number, and the TSO number: (1) Each component that is easily removable (without hand tools); and, (2) Each subassembly of the article that you determined may be interchangeable. This text is not in the Order 8150.1D Appendix G TSO Template.	Remove the referenced text.	Partially accepted. The TSO was updated to clarify that only subassembly part number of the approved TSO configuration is applicable here. The TSO number was removed.

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28.	Garmin	Sec 5.a.(2) Page 4	Section 5.a.(2) states: One copy of the test results from the testing using RTCA DO-311A, Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems, dated 19 December, 2017. Section 7.a requires that data in paragraphs 5.a and 5.b of this TSO be provided as furnished data to entities such as "an operator or repair station". Test results are not usually included as furnished data to customers and this requirement is not included in the Order 8150.1D Appendix G TSO Template. These test reports include proprietary information and providing a complete set of test results in a manual intended for installation details is unnecessary. Most DO-311A test data (battery energy, maximum temperatures, shutdown duration, capacity, etc.) is not required for the proper installation, certification, use, or continued compliance of the non-rechargeable cells and batteries. Installation limitations and consideration provided to the customer should be determined by the TSOA holder and is also not mandated per DO-311A section 3.2.2, Installation Design.	Delete section 5.a.(2). If there are specific data recommendations from the DO-311A test results, these should be highlighted within the TSO Section 7.a. or Appendix 1 (e.g. Thermal Runaway Containment Video, hazardous gas emissions, etc.). It should not be required by the applicant to provide the full set of test results required by RTCA/DO-311A, Section 2.4 to customers, operators, or repair stations.	Partially accepted- 5.a.(2) is clarified to only include a summary of test results including pass/fail criteria and the required reportable information according to paragraph 3 of this TSO

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29.	Garmin	Sec 5.a.(4) Page 4	Section 5.a.(4) states the installation limitations must include the following note: "This article meets the minimum performance and quality control standards required by a technical standard order (TSO) C179b. Installation of this article requires separate approval." This text does not align with the text identified in the Order 8150.1D Appendix G TSO Template.	Update to align with the text in the Order 8150.1D Appendix G TSO Template: "This article meets the minimum requirements of TSO-C179b. Installation of this article requires separate approval."	Accepted. TSO updated

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30.	Garmin	Sec 5.a. Page 4	Section 5.a is missing the following subsections from the TSO Template in Order 8150.1D Appendix G: (4) For each unique configuration of software and airborne electronic hardware, reference the following: (a) Software part number, including revision and design assurance level, (b) Airborne electronic hardware part number including revision and design assurance level, and (c) Functional description. and (7) By-part-number list of replaceable components that makes up the {insert type of equipment}. Include vendor part number cross-references, when applicable.	Add referenced text from the Order 8150.1D Appendix G TSO Template.	Accepted. TSO updated

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31.	Garmin	Sec 5.b. Page 4	The end of section 5.b is missing the following text from the Order 8150.1D Appendix G TSO Template: Include recommended inspection intervals and service life, as appropriate.	Include the referenced text from the Order 8150.1D Appendix G TSO Template.	Accepted. TSO updated

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32.	Garmin	Sec. 7.b Page 6	Section 7.b includes the following: b. If the article contains software, include one copy of the OPR summary. This is consistent with the Order 8150.1D Appendix G TSO Template. However, the TSO Template considers this "furnished data" that is required to be provided to any "entity (such as an operator or repair station)". Operators and repair stations typically do not have the same capability as a TC/STC design approval holder to make an appropriate assessment of OPR effect. Consequently, it will only serve to cause confusion to require an OPR summary to be provided to operators and repair stations. This same concern has been raised in the context of the FAA/EASA/Industry A(M)C 20-OPR discussions.	Remove section 7.b or limit its scope so that the OPR summary only needs to be provided to TC/STC design approval holders.	Accepted. TSO updated. The scope of the item was confined to 'within functional inputs'.

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33.	Garmin	Various	The text related to non-TSO functionality in the Order 8150.1D Appendix G TSO Template is missing in this TSO. Details on providing information on software and airborne electronic hardware are included in this TSO, and it would be expected that included software and airborne electronic hardware may also incorporate additional functionality beyond that identified in the TSO, including functionality that would be considered as a non-TSO function.	Include all non-TSO function text from the Order 8150.1D Appendix G TSO Template.	Not accepted. Non-TSO functions are not applicable for this TSO.

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34.	Garmin	Various	The following minor deviations exist from the Order 8150.1D Appendix G TSO Template: • Section 1 (bold text is missing). "or letter of **TSO** design approval (LODA)" • Section 3.g. (replace strikeout with bold text): "compliance **with** ~~to~~ the criteria" • Section 3.g. (replace strikeout with bold text): "Apply for a deviation **pursuant to** ~~under the provision of~~ 14 CFR § 21.618" • Section 5. (capitalize Aircraft Certification Office): "You must give the FAA aircraft certification office (ACO) manager" • Section 5.a.(1) (replace strikeout with bold text): "Operating instructions and **article** ~~equipment~~ limitations sufficient" • Section 5.g. (remove strikeout text): "A description of your organization ~~as~~ required by 14 CFR 21.605." • Section 7.a. (replace strikeout with bold text): "provide one copy or **online** ~~on-line~~ access to the data"	Suggest making appropriate changes to align with the Order 8150.1D Appendix G TSO Template.	Accepted. Good comments. TSO updated

35.	True Blue Power		"… must meet the MPS qualification and documentation requirements in section 1 and section 2 of RTCA document, DO-311A…"	SUGGESTED CHANGE: "… must meet the MPS qualification and documentation requirements in section 2.2, 2.3, and 2.4 or RTCA document, DO-311A…" RATIONALE: Technically, Sections 1 does not contain requirements. The reference to the energy and venting categories are already covered in the sentence that follows this one. For section 2.1, there are General Requirements, but none of them have specific means of compliance identified, therefore, are not part of the Equipment Requirements of 2.2. In order to avoid confusion and undetermined means to show compliance to these general requirements, we believe that 2.1 should not be included in the TSO MPS.	Not accepted. The TSO is a design and production approval. It includes design, manufacturing test and validation processes. Section 1 does include design and production aspects that will be required for the TSO. Section 2.3 also contain pertinent testing requirements.

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36.	True Blue Power	Sect 4.a; pg 2	"Mark each cell or battery permanently and legibly with all the information in 14 CFR § 45.15(b) and section 2.1.3 of RTCA/DO-311A. The marking must include the serial number."	SUGGESTED CHANGE: "Mark the article permanently and legibly with all the information in 14 CFR § 45.15(b) and section 2.1.3 of RTCA/DO-311A. The marking must include the serial number." RATIONALE: The information in 14 CFR § 45.15(b) and section 2.1.3 of RTCA/DO-311A is not practical nor appropriate to be marked on individual cells or battery sub-assemblies. The marking should apply to the TSO'd article only.	Accepted. TSO updated
37.	True Blue Power	Sect 4.b; pg 2	"Mark the lithium cell, battery and battery system based on the following table:"	SUGGESTED CHANGE: "The article marking shall include the TSO classification based on the following table:" RATIONALE: Similar rationale as Item 1. It is only appropriate to mark the energy and venting category on the TSO'd article, not individual cells or battery sub-assemblies.	Accepted. TSO updated

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38.	True Blue Power	Sect 4.b; pg 3	"Label the TSO as TSO C179b-CLASS A-X or TSO C179b-CLASS B-X as shown below (where –X stands for energy and venting category as listed in the table below): TSO C179b CLASS A – During the RTCA/DO-311A section 2.4.5.5 Battery Thermal Runaway Containment Test All cells within the battery must enter Thermal Runaway. TSO C179b CLASS B – During the RTCA/DO-311A section 2.4.5.5 Battery Thermal Runaway Containment Test Not all cells within the battery enter Thermal Runaway.	SUGGESTED CHANGE: "Label the TSO as TSO C179b-X (where –X stands for energy and venting category as listed in the table below):" *[strike the follow-on definitions of Class A and Class B]* RATIONALE: There is no inherent value in identifying whether ALL cells within a battery experience thermal runaway during DO-311A, 2.4.5.5. The test requires that the <u>entire battery</u> be subjected to conditions that <u>must</u> initiate a thermal runaway (TR). Additionally, evidence must be produced that multiple cells have actually experienced TR. This is sufficient to identify the likely hazard associated with a worst-case scenario. If some, but not all, of the cells in a battery experience TR, this is a natural consequence of the battery design and representative of its hazard. Using a Classification system to indicate that a battery which has 7 of 8 cells experience TR should somehow be limited in its application, rather than one that demonstrates 8 of 8 cells, would not be useful or appropriate. (or 99 of 100, etc) And because there is no currently defined impact/result as to identifying a product as Class A or Class B, it seems additionally unnecessary to differentiate products at such a high level as the TSO qualification based on this factor. Review of the test results during the installation certification would be a more appropriate place to determine the potential risk or implications of a battery in which a majority of the cells did/did not experience TR.	Not accepted. The need for the two-class identification is to help applicants during certification process for installation of the article on aircraft.

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39.	True Blue Power	Sect 4.b; pg 3	"Label the TSO as TSO C179b-CLASS A-X or TSO C179b-CLASS B-X as shown below (where –X stands for energy and venting category as listed in the table below):" – [reference table]	SUGGESTED CHANGE: "Label the TSO as TSO C179b-X (where –X stands for energy and venting category as listed in the table below):" [referenced table] -X Energy Venting -1A 1 A -1B 1 B -1C 1 C -2A 2 A … etc RATIONALE: Since X could potentially represent a 2-digit number anyway in the currently proposed version, TBP recommends to simply identify the Energy and Venting categories with their actual designation per the DO-311A document rather than a 'translated' equivalent that requires decoding. A second, but less desirable alternative might be an "-X" that is represented by -11, -12, -13, -21, -22, -23, -31… etc. That way, it is more interpretable without referencing the table.	Accepted. Good suggestion; TSO updated. The TSO is updated in a similar fashion. Rather than having only 0ne digit which may cause confusion, we still had two digits to clearly state the energy and venting differentiation. Therefore the TSO is updated to TSO C179b-XY where X stands for energy and Y stands for venting category.

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40.	True Blue Power	Sect 4.c; pg 3	"Also, mark the following permanently and legibly, with at least the manufacturer's name, subassembly part number, and the TSO number:"	SUGGESTED CHANGE: "Also, mark the following permanently and legibly, with at least the manufacturer's name and subassembly part number:" RATIONALE: It would not be appropriate to mark individual removable components or sub-assemblies with the TSO number. That would indicate that those components/sub-assemblies are TSO'd, when in fact, they are not (unless/until assembled as part of the TSO'd system).	Accepted. The TSO updated to reduce the scope of this item. The TSO number requirement is removed from this item.

Combined Public Comment Matrix

41.	True Blue Power	Sect 5.a; pg 4	"**(2)** One copy of the test results from the testing using *RTCA DO-311A, Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems*, dated 19 *December*, 2017."	SUGGESTED CHANGE: Move and/or append this section (5.a.2) to 5.j. Renumber sections 5.a(3)-(6) to 5.a(2)-(5). RATIONALE: According to Section 7.a, the TSO holder must provide the data in 5.a and 5.b to an entity (operator or repair station). However, most of the data in 5.a and 5.b is typical of a product's Install and Operation Manual, except for 5.a(2). It would not be practical or within the scope of the information to include the DO-311A test results. Also, 5.a(2) is essentially identical to 5.j. Therefore, we recommend they be combined in 5.j or stricken since it is redundant to 5.j. This is similar to other TSO's as well (ref C201 for example) Also note that the statement in 7.a says: "Add any other data needed for the proper installation, certification, use, or for continued compliance with the TSO, of the rechargeable lithium batteries and battery systems." This would include the DO-311A test results (so the installer can review as needed). If desired, additional emphasis could be placed on this in 7.a. (See next comment/suggestion)	Partially Accepted. We clarified the requirement for the test results.

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42.	True Blue Power	Sect 7.a; pg 6	"Add any other data needed for the proper installation, certification, use, or for continued compliance with the TSO, of the rechargeable lithium batteries and battery systems."	SUGGESTED CHANGE: "Add any other data needed for the proper installation, certification, use, or for continued compliance with the TSO, including the test results associated with RTCA/DO-311A as required, for the rechargeable lithium batteries and battery systems." RATIONALE: This highlights the potential need of the installer to review the RTCA/DO-311A test results of the product and compels the manufacturer to provide it on request. (However, in conjunction with Comment #5 above, does not require the distribution of those results in otherwise public documentation that is out of scope.)	Accepted. The TSO was updated. The required test results are now in section 5 a 2. There is no proprietary data in these tests results.
43.	True Blue Power	Sect 8.b; pg 6	"b. Order SAE documents…"	SUGGESTED CHANGE: Remove Section 8.b. RATIONALE: There are no SAE documents referenced in the TSO. It could/should be removed from the "How to Get Referenced Documents"	Accepted. TSO updated.